



UNIVERSITI PUTRA MALAYSIA

**EVALUATING THE COST OF QUALITY IN THE FURNITURE
FACTORY**

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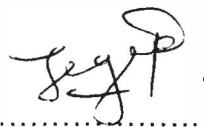
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ABSTRACT

Abstract of profesional paper presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirements for the degree of Master of Science

EVALUATING THE COST OF QUALITY IN THE FURNITURE FACTORY

By

AHMAD FAUZI OTHMAN

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The study was carried out in a furniture factory, which specialises in manufacturing of bedroom, and dining set furniture for export market. The purpose of this study was to identify the quality cost and to provide guidance to general management and quality program management to enable them to structure and manage programs to assist in the overall product cost reduction. The cost of quality was divided into four groups, which were prevention cost, appraisal cost, internal failure cost and external failure cost. The prevention cost was 30.2%, appraisal cost was 17.6%, internal failure cost was 43% and external failure cost was 9%. The major contributor internal failure cost was from down grading cost, valued at RM 30,000, The main contribution from prevention cost was quality planning around Rm 30,000. Receiving inspection gave a higher value in appraisal cost , which was RM 13,800 and the external cost just contributed only RM 10,000. Warranty claim was the most highest cost, it came from the department of Replacement Part or RP. From the result it showed that typical ratio for TQC as a percentage of sales was 15%, value added was 37% and direct labor cost was 2.7%. The value of direct labour cost was below 5% (international standard). This showed that this company has an efficient quality program and well trained staff to fulfill the quality requirements.

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Quality has been in a state of transition over time. During and after the Second World War a move from an inspection orientation to one of statistical quality control evolved. Along with the national concern for cost containment came the recognition among the quality practitioners of the cost effects of quality and thus development of quality costs analysis. Now, in response to the depletion of resources and the need for improved productivity, it is incumbent upon the quality profession to assist in this effort; its measurement and control (Esterby, 1987).

The basic concept of quality costs is recognition and organisation of certain quality-related costs to gain knowledge of their major contributing segments and of the direction of their trends (Anon, 1971). This definition implies two conditions. First, the product quality carries with it a cost association that needs to be recognised and controlled. Second, these costs are time variant and therefore need to be considered and tracked over time. Costs, so identified, are extremely valuable to management in measurement, analysis and budgeting.

Quality costs have been categorized into the four elements; i.e. prevention, appraisal, internal failure and external failure. These elements have been defined as follows :-

1. Prevention

Costs associated with personnel engaged in designing, implementing and maintaining the quality system.

2. Appraisal

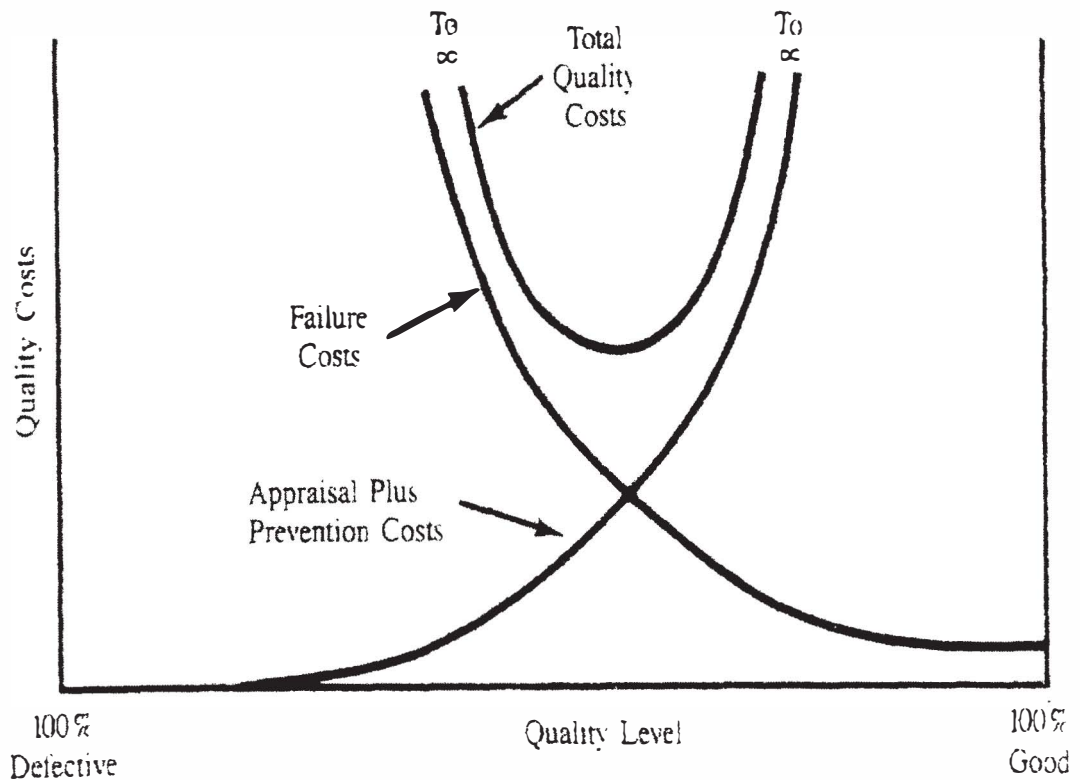
Costs associated with measuring, evaluating or auditing products, components and purchased materials to assure conformance with quality standards and performance requirements.

3. Internal Failure

Costs associated with defective products, components and materials that fail to meet quality requirements and cause manufacturing losses. These costs occur prior to shipment of the product to customers. Historically, this element has been the largest component of quality costs.

4. External Failure

Costs generated by defective products being shipped to customers. This element has historically been the most elusive costs to identify and record. The term failure costs means the summation of internal and external failure costs unless specifically stated otherwise. Aggregated failure costs, with rare exception, comprise the vast majority of total quality costs. The four elements of quality costs have been found to have the relationship depicted in Figure 1.



Source: Esterby, 1987

Figure 1 : Quality Cost Relationship

As product quality tends towards the 100% defective level, failure costs tend toward infinity while appraisal plus prevention costs tend towards zero. As product quality tends towards the 100% good level, failure costs tend towards zero while appraisal plus prevention costs tend toward infinity. Total quality costs are the algebraic sum of appraisal, prevention and failure costs at each point along the axis. The total quality costs curve is seen to have a minimum point, the point at which the other two curves intersect. It is desirable to have the organisation operate at this point of minimum total quality costs (Esterby 1987).

1.2 Justification of Study.

This case study aims to provide guidance to general management and quality program management to enable them to structure and manage programs that should be able to assist in the overall product cost reduction. The guide provides the procedures for taking total quality costs and using them for identifying problem areas and for reducing these costs. Quality costs covered included those in the design, manufacture, inspection test and product service phase. Improvement programs must encompass all phase of product life, from design through use by the customer.

The result from this study can assist in determining the most significant or the most frequent contributors to the undesirable situation being reported and to identify their elimination as the most profitable avenue to improvement. That is, as the areas which will provide the biggest payback for the expenditure on budgets for the investigative and corrective actions. The step-by-step investigation and elimination of identified contributors to failure costs is the overall object of performance analysis. These steps then become a series of incremental cost reductions that add up to significant overall improvement.

1.3 Objective

The objective of this study is to determine the cost of quality in furniture manufacturing.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of the Malaysian Furniture Industry

Furniture manufacturing in Malaysia is primarily a traditional industry, which have been imparted from one generation to another as a family business. In the past, most of them used manual equipment and they were characterised as a small-scale industry, which, entertained markets that, suits their production facilities. They remained persistently small until the 70's when the rapid housing development and construction activities induced the growth of the industry (Fauzi, 1990).

The furniture-manufacturing sector is fast developing into a major downstream wood processing. At present, there are about 2,965 furniture and woodworking mills scattered throughout the country. Peninsular Malaysia has more than 2,630 mills compared to Sarawak and Sabah with 215 and 120 mills respectively. These mills range from small cottage operation producing for the domestic market right up to the larger automated plants equipped with sophisticated machinery capable of mass production for export (MTIB, 1998).

The Furniture industries has been identified as a "target industry" under the government's second Industrial Master Plan (IMP) for the period of 1996 to 2005. Towards this, the furniture manufacturers would need to keep abreast with the latest development in processing technology and also improve their production skills for the manufacture of high quality product (MTIB, 1998).

Export of Malaysian manufactured furniture includes knockdown chairs and tables, stackable chairs, early American-design chairs using turned parts, garden furniture, rattan furniture and furniture parts utilizing wood, rattan, metal and plastic. These local contemporary design and custom-designed furniture are applicable for both commercial usage and home furnishing (MTIB, 1995).

The wooden and rattan furniture industry, in the country, showed a positive growth. Export of wooden and rattan furniture expended further in 1997 and 1998 to RM 2.6 billion and RM 3.3 billion respectively. Major markets were the United States, Japan, Singapore, United Kingdom and Taiwan (Anon, 1999).

2.2 History of Quality

The concept of the economic of quality can be traced back to the early 1950s. Chapter 1 of Dr. J. Juran's first "Quality Control Handbook" published in 1951, was titled "The Economics of Quality" and contained discussions of the "Cost of Quality". Among the earliest articles on Quality Costs Systems were Harold Freeman's 1060 paper, "How to put Quality Costs to use" and Chapter 5 of Dr. A.V. Feigenbaum's famous text, "Total Quality Control" published in 1961. They are among the earliest writings categorising Quality Costs into the costs of Prevention, Appraisal, Internal and External Failure.

In 1961, the National Chairman of ASQC, A. V. Feigenbaum, was appointed as the Economic Survey Committee with Rocco Fiaschettias chairman to determine the national quality cost. The broad objective was to developed a survey of American industry for

the determination of quality costs as a percentage of net sales billed. A secondary purpose was to dramatise the magnitude and importance of product quality, and to gain recognition for ASQC as a reliable and up-to-date source for quality cost information. It was perceived that differences in accounting systems and methods of collecting costs made comparisons among companies inequitable although trends of a company's costs would be beneficial. The study pointed out the need for standardisation of quality cost terminology and methodology. Under the leadership of Daniel Lundvall, the committee was officially renamed the Quality Costs Technical Committee. The basic task was to produce a document to categorise the content of a quality cost program and define the elements. This was the beginning of the handbook on quality cost. The first issue was distributed at the Annual Technical Conference in 1967. "The Bibliography of Articles" regarding quality costs was started in 1967, published in 1973 and updated annually thru 1979 by Edgar W. Dawes, thereafter by Clyde W. Brewer. Under the guidance of Chairman Joseph Farnam (1972-1975), eight task groups were found. Task group Seven's purpose was to develop and publicise methods used to reduce the costs of quality, and actions resulted in the 1977 publication titled, "Guide for Reducing Quality Costs (Grimm, 1987).

2.3 Quality

The notion of quality has been defined in different ways by various authors Garvin (1984) divided the definition of quality into five categories, namely, transcendent, product-based, user-based, manufacturing based, and value-based. Furthermore, he identified a framework of the following eight attributes that may be used for defining quality which were performance, features, reliability,

conformance, durability, serviceability, aesthetics and perceived quality. One frequently used definition attributed as "Quality is conformance to requirements or specifications". A more general definition proposed by Juran (1974) is "Quality is fitness for use"

2.4 Quality Costs

A measure of the performance of the total quality system is the total cost associated with it. Careful identification, measurement and analysis of the total cost as a function of time aids in tracking the impact of an effective statistical quality control system. The American Society for Quality Control (1971) has defined four major categories for quality costs, each of which is discussed below.

2.4.1 Prevention Costs

Prevention costs are the costs incurred for planning, implementing and maintaining a quality system. They included salaries and development costs for product design, process and equipment design, process control techniques (through means such as control chart), information systems design and all other costs associated with making the product right the first time. Also, costs associated with education and training regarding quality control procedures for all involved personnel are included in this category. Other such costs includes those associated with defect cause removal, process changes and the cost of a quality audit. Figure 2 shows a typical breakdown of the quality costs as a function of time into four categories. As the figure shows, prevention costs increase with the introduction of a quality system and may be a significant proportion of the total quality costs. The rate of increase decrease with time. Even

though prevention costs increase, they are more than justified by causing a decrease in total quality costs.

2.4.2 Appraisal Costs

Appraisal costs include the costs associated with measuring, evaluating or auditing products, component or purchased material to determine their degree of conformance to the specified standards. Such costs included dealing with the inspection and test of incoming materials as well as product inspection and test at various phases of manufacturing and at final acceptance. Other costs in this category include the cost of calibrating and maintaining the measuring, instruments and equipment and the cost of material and product consumed in a destructive test or devalued by reliability tests. Appraisal costs typically occur during or after production but before the product is released to the customer. Hence, they are regarded as the costs associated with managing the outcome, whereas prevention costs are associated with managing the intent or goal. Figure 2 shows that appraisal costs normally decline with time as more nonconformities are prevented from occurring.

2.4.3 External Failure Costs

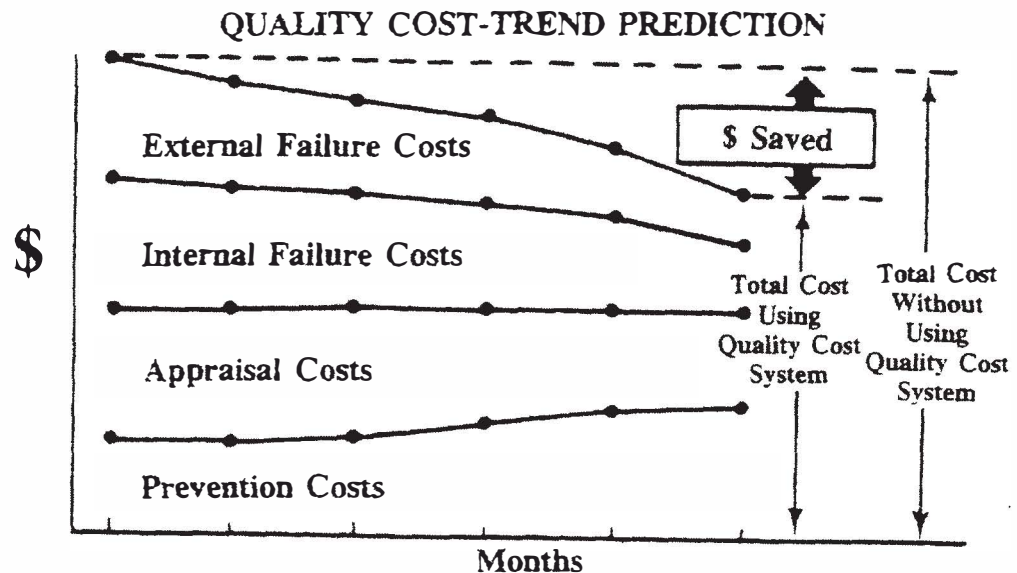
External failure costs are incurred when the product does not perform satisfactorily after ownership is transferred to the customer. If no conforming units were produced, this cost would vanish. Such costs include those due to customer complaints, which include the costs of investigation and adjustments and those associated with receipt, handling, repair or replacement of nonconforming products. Also, warranty charges related to failure of a product within the warranty time should be budgeted for product liability costs, which involve costs

or awards as an outcome of product liability litigation, also fall under this category. As shown in Figure 2, a reduction in external failure costs takes place over time following the successful implementation of a quality control system. The major impact of a quality system is to cause a reduction in the internal and external failure costs, which in turn reduces the total quality costs.

2.4.4 Internal Failure Costs

Internal failure costs are incurred when products, components, material and services fail to meet quality requirements prior to the transfer of ownership to the customers. These costs would disappear if there were no nonconformities in the product. Achieving a zero defects program is the appropriate course of action. Internal failure costs included scrap and rework costs that may include materials, labor and overhead associated with production. The cost of correcting nonconforming units, as in rework, may include such additional manufacturing operations as regrounding the outside diameter of an oversized part. If the outside diameter were undersized, it may not be feasible for use in the finished product. Costs to determine the cause of product failure or the costs to reinspect or retest product that had to be reworked are other examples of costs in this category. The cost of lost production time due to nonconformities must also be considered (for example, poor quality of raw materials may require retooling of equipment). Furthermore, downgrading costs that include lost revenue from selling a flawed product at a lower price than normal are another component. As a total quality system is implemented and becomes effective with time, internal failure costs will decline, as shown in Figure 2. Less scrap and rework will result as problems are prevented. This is one of

the reasons for the reduction in total quality costs overtime following the implementation of a quality control system.



Source: ASQC, 1971

Figure 2 : Quality Cost-Trend Prediction.

2.5 The Importance of Quality

An improvement in quality can lead to increased market shares, improved competitive position, and increased profitability.

2.5.1 Market Shares

With a reduction in external failure costs and improved performance of the product in its functional phase, the company is in a position to raise the satisfaction level of its customers. Many of them return to buy the product again. Also satisfied customers spread the word about good quality, which leads to additional customers. Market share goes up as the quality level goes up (Amitara, 1989).

2.5.2 Competitive Position

The mission of any organisation is to stay competitive and to constantly strive to improve its competitive position. Efforts to improve quality help in the attainment of that mission. Through process control and improvement and efficient resource utilisation (reduce production of scrap and rework) a firm can keep its cost minimal. So, even if the selling price remains fixed, an improved price/costs ratio is achieved. Alternately, as quality improves, the firm can change to a higher price for its product. Customer satisfaction and expectation will eventually determine the price of the product. In any event, an improved competitive position paves the way to increase profitability (Amitara, 1989).

CHAPTER THREE

METHODOLOGY

3.1 Study Site

The study was carried out in Tomisho Holding Berhad. The factory is located in Jln Haji Abdul Manan, Meru, Klang, Selangor. The factory activities are manufacturing of bedroom and dining set furniture.

3.2 Data Collection and Experimental Design

The collection of the data was done through a form submitted to the Quality Assurance manager (Appendix 1). This form was designed in accordance with BS 6143. The descriptions of the item listed are as follow: -

3.2.1 Prevention cost

This includes two areas in Quality Control which are :-

- a) Design and development of quality measurement and control equipment. Typical areas and titles of personal performing this type of work may include the following :-
 - i) Test Equipment Engineers.
 - ii) Test Equipment Planners and Designers.
 - iii) Inspection Equipment Engineers.
 - iv) Gauge Engineers and Designers.

b) Quality planning.

Quality planning by function other than quality assurance.

Cost elements in prevention are: -

- i) Laboratory engineers who plan the testing of incoming, in-process and final product.
- ii) Manufacturing engineers who plan inspection and test test equipment.
- iii) Manufacturing or industrial engineers who develop inspection and test procedure for quality measurements as requirement by the quality plan.
- iv) Engineering personal who plan and direct initial product qualification.
- v) Sales personal who develop visual quality standards.
- vi) Engineering personal who develop acceptance standards.

c) Calibration and maintenance of production. These mainly include equipment used to evaluate quality. The cost of calibration and maintenance of templates, jigs, fixtures and similar items should be included.

d) Maintenance and calibration of test inspection equipment used in quality control.

The cost for maintaining or calibrating test and equipment used in the product, such as overload thermostat in an electric motor, should be included.

e) Supplier Assurance

This represent the cost of personnel engaged in the preventive activities of supplier quality assurance programs which include: -

i) Evaluations.

- a. Supplier's surveys, audits and rating
- b. Identifying new sources of supply.
- c. Design evaluation and testing of alternative product.
- d. Purchased order review before placement.

ii) Planning

- a. Determining and documenting method of supplier control
- b. Planning incoming inspection and test requirement.
- c. Carrying out supplier process capability exercise.

f) Quality training

Represent the cost of developing, implementing, operating and maintaining quality training programs.

3.2.2 Appraisal cost

These are costs on: -

a) Laboratory acceptance testing

Cost related to evaluate the quality of purchased material (raw, semi finished or finished) which becomes part of the final product or that is consumed during production operation.

b) Inspection and test

Payroll cost of inspection and test personnel, including supervision and clerical support (including receiving inspection)

c) Inspection and test materials

Material consumed or destroyed in control of quality includes costs of material and supplies used in test and inspection work, report, stationary, gloves and processing chemical. The cost of test and inspection equipment should be excluded.

3.3.3 Internal failure cost

a) Troubleshooting or defect/failure analysis.

The cost incurred in analyzing non-conforming material, components or product to determine causes.

b) Reinspection and restarting

The cost of reinspection or restarting material that has failed previously.

c) Scrap, rework, fault of sub-contractors and downtime.

The losses incurred due to failure of purchased material to meet quality requirements and payroll costs incurred.

d) Modification permits and concessions

The cost of the time spent in reviewing product, design and specification.

e) Down grading

The losses due to non-conformance for quality reasons, resulting in a reduced selling price.

3.3.4 External failure cost

The failure costs are incurred from: -

a) Complaint

The payroll cost of administrating complaints.

b) Product liability

The cost of product services are directly attribute able to correcting imperfection, including any product liability.

c) Product repeated and returned

The cost of handling and accounting for rejected products, including any recall and retrofit costs.

d) Warranty replacement

Marketing errors, design/specification errors and factory or installation errors.